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# An Empirical Analysis of Land Degradation Risk from Local Community Knowledge Perspective: The Case of Geze Gofa District, Southern Ethiopia

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**Abstract**
Land degradation is increasing in severity and extent in many parts of the world. Success in arresting land degradation entails an improved understanding of its causes, process, indicators and effects. Various scientific methodologies have been employed to assess land degradation globally. However, the use of local community knowledge in elucidating the causes, process, indicators and effects of land degradation has seen little application by scientists and policy makers. Land degradation may be a physical process, but its underlying causes are firmly rooted in the socio-economic, political and cultural environment in which land users operate. Analyzing the root causes and effects of land degradation from local community knowledge, perception and adapting strategies perspective will provide information that is essential for designing and promoting sustainable land management practices. This study was conducted in Geze Gofa district; southern Ethiopia. The main objective of the study was to analyze land degradation risk from local knowledge perspective. The study followed a multistage sampling procedure to select the sample respondent households for study. The sample size of the study was 156 households. The study was conducted using semi-structured interview schedule, key informant interviews, focus group discussions and field observation as a primary data collection techniques. The data analysis for this study was conducted using both qualitative approaches (thematically) and quantitative approach- descriptive statistics, and logistic regression analyses. The results of the study reveals that the local communities' elucidated the following indicators of land degradation in the study area: sheet, rill and gully erosions, soil accumulation around clumps of vegetation, soil deposits on gentle slopes, exposed roots, muddy water, sedimentation in streams and rivers, sandy layers, change in vegetation species, decrease in organic matter, increased runoff, reduced soil water and reduced rooting depth. The local community perceived causes related with direct human activities which were found to be influencing land degradation in the study area include: continuous cropping, overgrazing, deforestation, steep slope cultivation, extreme weather events (flood and drought) improper fertilizer use. Land shortage, poverty and high population density are the underlying causes of land degradation observed in the study area. According to the results, the consequences of land degradation experienced in the study area include; decline in crop yields, increased reduced responses to inputs, reduced productivity on irrigated land, loss of water for irrigation, lower and less reliable food supplies and increased labour requirements. The possibility of farmers' perception of the effects of land degradation effect on agricultural land productivity from slight to severe was primarily determined by institutional and demographic factors as well as weakly by biophysical factors. The study concludes that anthropogenic factors are significantly responsible for land degradation and this degradation has negatively affected livelihood in the study area. Generally, this study recommends that decision-making about land management and land degradation should encompasses factors that may be biophysical (agro-ecological conditions, location), economic (access to credit and markets, non-farm incomes, availability of technologies), social (organizational structure, labor availability, land tenure), historical (environmental history and that of land tenure) and cultural (traditional knowledge, environmental awareness, and gender.
**Keywords:** Land Degradation, Local Knowledge, Farmers' Perception, Conservation measures

## 1. INTRODUCTION

### 1.1. Background and Justification of the Study

Societies everywhere on the planet Earth are in one way or the other closely and inextricably linked to the natural environment in which they are embedded. Human productive and social activities and thus social structures and relations are shaped to a significant degree by the natural resource mix available, by physical geography, by weather patterns, by the amenability of natural conditions to transformation, and by a variety of other characteristics of the environment (FAO, 2013; Lal, 2012). Land is a vital resource for producing food and other ecosystem goods and services including conserving biodiversity, regulating hydrological regimes, cycling soil nutrients, and storing carbon, among others (Nachtergaele, 2010; Nickerson,2012). Indeed, the most significant geo‐resource or natural capital is productive land and fertile soil (Lal, 2012; FAO, 2010). For those communities that rely heavily on land as their main asset, especially the rural poor, human well‐ being and sustainable livelihoods are completely dependent upon and intricately linked to the health and productivity of the land (Pingali, 2012). In spite of this, for a long time, the true value of land has been underappreciated and in particular the ecosystem services they provide have been taken for granted (Wood, 2013; Samuel, 2012; FAO, 2010)

Land degradation is a broad, composite, and value-laden term that is complex to define but generally refers to the loss or decline of biological and/or economic productive capacity (FAO, 2014; Global Environmental Facility, 2012). Land degradation is a multifaceted event triggered by the interaction of environmental, economic and social factors (Warren, 2002; Geist and Lambin, 2004; Reynolds *et al*., 2007). It is reaching a significant level especially in rural areas of developing countries where its impacts are more ruthless (Safriel, 2007; Bai *et al.,* 2008). Land degradation is all about any diminishment of biodiversity and ecosystem functioning that negatively impacts the provisioning of ecosystem services and ultimately impedes poverty eradication and sustainable development effort. Land degradation is a temporary or permanent decline in the productive capacity of the land or its potential for environmental management. In East Africa, it is the smallholder farming systems on the highlands which are the hardest hit with soil erosion (Kangalawe and Lyimo, 2010; Gewin, 2002; World Bank, 2012). Global land degradation assessments indicate that the percentage of total land area that is highly degraded has increased from 15% in 1991 to 25% by 2011. If the current scenario of land degradation continues over the next 25 years, it may reduce global food production, from what it otherwise would be, by as much as 12% resulting in world food prices as much as 30% higher for some commodities (IFPRI 2012). This at a time when population growth, rising incomes and changing consumption patterns are expected to increase the demand for food, energy and water, by at least 50%, 45% and 30%, respectively by 2030 (FAO 2011; Ramankutty *et al.*, 2012 ). These expected levels of global demand cannot be met sustainably unless we conserve and rehabilitate the fertility of our soil thus securing the productivity of our land. Achieving land degradation neutrality, i.e. when the pace of restoring the already degraded land is at least equals, but preferably exceeds, the rate of new land degradation, is thus essential to achieve the sustainable development goal of reducing poverty (Lal *et al*., 2012). Without zero net land degradation, it would be also very difficult to meet other global sustainable development targets such as preventing further biodiversity loss, or mitigating and adapting to climate change. Despite these dynamics requiring urgent attention to prevention of land degradation, the problem has not been appropriately addressed, especially in the developing countries (Kissinger *et al.*, 2012

Land is the most vital and heavily threatened natural resource in Ethiopia because smallholder agriculture is the economic mainstay of the overwhelming majority of Ethiopian people and will continue to remain so in the near future (Pender, and Berhanu, 2004; USAID, 2000; Wagayehu, 2003). However, the on-going land degradation has threatened the sustenance of their livelihood. The Ethiopian highlands are affected by deforestation and degraded soils, which have eroded the resource base and aggravated the repeated food shortages caused by drought. Although the Highlands occupy 44% of the total area of the country, 95% of the land under crops is located in this area, which is home to 90% of the total population and 75% of livestock (). Declining vegetative cover and increased levels of farming on steep slopes have eroded and depleted soils in the area, so that soil degradation is now a widespread environmental problem. Farmers also have to cope with nutrient mining caused by insufficient application of fertilizers, shorter fallow periods and low levels of soil organic matter. Land degradation is the major cause of the country's low and declining agricultural productivity, persistent food insecurity challenge, and abject rural poverty (FAO, 2012). The minimum estimated annual costs of land degradation in Ethiopia range from 2 to 3 percent of agricultural GDP (FAO, 2010). This is a significant loss for a country where agriculture accounts for nearly 45 percent of GDP, 90 percent of export revenue, and is a source of livelihood for more than 82 percent of the country's 100 million people (Pender, and Berhanu, 2004; USAID, 2000). So, in Ethiopia, land degradation, low and declining agricultural productivity, food insecurity and poverty are chronic and highly intermingled problems that appear to feed off each other. If urgent measures are not taken to arrest Ethiopia's serious land degradation disaster, the country is headed for a "catastrophic situation" (Getinet and Tilahun, 2005).

Recognizing the threat of land degradation, the government of Ethiopia has made several natural resource management efforts through various interventions such as productive safety net programme( PSFP), Food for Work programme and MERET and MERET PLUS Programme since mid-1970s and 80s (Aklilu, 2006; Shiferaw and Holden, 1998). As a result a range of land conservation practices, which include stone terraces, stone bunds, area closures, and other soil and water conservation technologies and practices have been introduced into individual and communal lands at massive scales. However, studies points out that farmers adoption of SLM practices at lower rate and more often they dis-adopt them (Aklilu and de Graaff, 2007; ELD Initiative, 2013). In most places, implemented SWC Structure was either totally or partially destroyed by farmers (Tesfaye *et al*. 2013; Kassie *et al*., 2009; Tiwari *et al*., 2008; Bewket, 2007). The conventional top-down planned government efforts and programs to conserve natural resources were not succeeded where they are most needed. This partially could be, because of unbalanced focus towards technical expertise knowledge and perception by external agents and latest technological aids to explain the causes, the process, and effects of land degradation and disregarding the crucial actors' local communities' knowledge, views and perception in assessment of land degradation. Studies undertaken this area attempt to assess the causes of land degradation are often extremely deterministic or tend to present a ''shopping list'' of causes (Tesfa, and Mekuriaw, 2014). In the former case, the driving factors of land resource degradation tend to be perceived from a particular lens or theoretical perspective, such as neo-Malthusianism or neo- Marxism. Such studies tend to present only a half-done picture, as specific data are collected often in an attempt to corroborate or disprove the perspective to the exclusion of other potentially relevant data or perspectives (Jones, 1999). In the latter case, studies lack explanatory power as they fail to identify the specific links and mechanisms between social variables and land degradation. Structuration theory, developed by Anthony Giddens, and operationalized in development research through the actor-oriented approach (Long, 1992) is a sociological framework that may be usefully applied to help overcome these problems encountered in land degradation and soil conservation research. In taking the level of analysis as the ''situated contexts'' and everyday lives of actors and exploring the ''interplay and mutual determination of 'internal' and 'external' factors and relationships'' (WOCAT. 200;), the actor-oriented approach enables the explanation of differential responses to similar structural circumstances and avoids the excessive determinism that plagues social explanation. In so doing it may be better used to understand peoples' interaction with promoted technology and, with respect to the study of land degradation, enables us to attribute a wide range of potential causes from local cultural variables, to more abstract structural influences on people's actions. Furthermore, by placing emphasis on understanding processes in particular places, it helps reveal how ''factors become causes,'' that is, the mechanisms underlying change (WOCAT. 2011).

Local communities' perspective of land degradation risk could be understood from three vantage points. Firstly, local community could perceive land degradation on the basis of their socio-economic interests. In this case, farmers will be more aware and concerned about land changes and degradations that negatively impact agricultural productivity such as soil erosion. Secondly, when these people understand that their farmland is degrading they will attempt to control some of their activities causing their farmplots degradation(Nsiah-Gyabaah,1994), thereby be more enthusiastic to support land management programmes if they are aware that their actions are harmful to the farmlands (Herberlein, 1972). The third perspective is that farmers are concerned about soil and/or land degradation as a general community problem, disregarding the fact that their own holdings are likely to be also at risk. Under such circumstances then no actions may be taken although such people hold positive attitudes towards conservation. However, it is believed that when the farmers themselves involved in fact-finding on their own land they become instrumental in implementing planned courses of action (Critchley, 1991). An effort to achieve zero net land degradation at the local scale appears to require more than technical expertise knowledge and perception by external agents such as agricultural scientists and government officials (WOCAT, 2011). Research has however shown that science has its limitations and cannot always provide an accurate and full. Thus basing on the local people's views and local knowledge then it is possible to develop methods which can allow the people themselves to provide the solutions to their land degradation problems (Nsiah-Gyabaah, 1994; Critchley, 1991). Since understanding the dynamics of land degradation at the village and farm level can enhances the success of policies and programmes to address land degradation, this study was attempted to analyze local community knowledge used in detecting and analyzing land degradation(the real causal factors, process, socio-economic effects and coping strategies) at the community level.

Generally, designing and implementation of successful sustainable land management practices require, among other things, a detailed understanding of the extent, risk and spatial distribution of the problem, including local concerns. So, this study was conducted with the aim to fill the gap in empirical analysis of land degradation risk from local community knowledge perspective. The specific objectives of the study were: 1) the objective of the study was to explore local approaches employed to assess land degradation by farmers of the study area. 2) Secondly, to analyze farmers' perception of the causes of the problem and their coping strategies. 3) To analyze the effects of land degradation from community local knowledge perspective. 4) To analyze the determinants of farmers' perception of the effects of land degradation risks on agricultural productivity in the study area.

## 2. Methodology of the Study

### 2.1. Description of the Study Area

The study was conducted in Geze Gofa district, which is one of the 15 districts located in Gamo Gofa Zone, Southern Ethiopia. The administrative center of Geze Gofa district, Bulki town, is located at a distance of 251 kilometers from the Zonal capital, Arba Minchi town, and 517 kilometers south west of Addis Ababa, the capital city of Ethiopia. Part of the Gamo Gofa Zone, Geze Gofa is bordered on the south by Oyda woreda , on the west by Basketo special woreda, on the northwest by Melokoza woreda , and on the east by Demba Gofa woreda. It is located approximately between coordinate 10033'06'' to 10050'24'' North latitude and 37042'36'' to 37058'24'' East longitude. Topographically, the area lies in the altitudes range of 690m to 3196m.a.s.l. As a result, the area is characterized by three distinct agro-ecological zones-Highland (*Dega*), Midland (*Woina Dega),* and Lowland (*Kola*), according to the traditional classification system, which mainly relies on altitude and temperature for classification. There are two (bimodal-belg and meher) distinct rainy seasons: the smaller one is the *belg*, from March to May. The main rains are in the *meher* season from July to September. The main system of farming that existed in the past was shifting cultivation, which was practiced because of the low population pressure at the time. As population pressure increased and settlements became more consolidated, shifting cultivation gave way to bush fallowing and land rotation which has now evolved into continuous cultivation. Land degradation manifests itself in the district in the form of low agricultural productivity due to low soil fertility and adverse climatic conditions, soil erosion and loss of vegetative cover. Low production also increases the poverty situation of farmers. High population pressure has forced farmers to cultivate steep areas that used to be earmarked for grazing or tree plots. Multiple cropping practices, such as intercropping and relay cropping, are common, thanks to the longer growing season resulting from the bi-modal rainfall pattern.

**2.2. Sampling Design of the Study**

This study employed a multi-stage sampling procedure. Fist, Geze Gofa district was purposively selected because it is one of the severely affected highland areas in the country in terms of land degradation and soil erosion. Geze Gofa district covers thirty one rural *kebeles*. A list of these villages was made and three of them were selected randomly, namely *Ale Aykina, Aykina Kasike and Ala Wuzete*. The district is a highland area with steep slopes, intensely cropped hillsides and high population densities. Second, three *kebeles* (*Ale Aykina, Aykina Kasike and Ala Wuzete*) selected from the 31 complete list of kebeles in the District using a simple random sampling technique. A total of 156 households (10% sample size of households in the study area) were interviewed by administering semi-structured interview schedule. The random sample of 10% of the kebeles and households selected for this study is considered to be representative enough for statistical analysis (Clarke, 1986). Under certain circumstances, such as resource constraints, even a smaller sample of 5% is regarded as being representative enough (Boyd *et al*, 1981).

**2.3. Data Collection Techniques and Tools**

Data for the study were collected from both primary and secondary sources. Primary data were collected by using the following data collection techniques and tools:

*1. Semi-Structured Interview Schedule:* A semi-structured interview schedule was used to collect both qualitative and quantitative data from the respondents. The data collected included information on households demographic and socio-economic characteristics; institutional services; communities views, perception and knowledge about causes and effects of land degradation; various land management practices adopted by farmers (collectively or singly); farmers' attitudes on the effectiveness of land management practices in reversing land degradation and enhancing productivity. Pilot-tests of questions were made by distributing questionnaire to five farmers in each site to assess whether the instruments were appropriate and suited to the study at hand. Necessary adjustments were made based on the comments obtained from pre-test responses from farmers to ensure reliability and validity. On the basis of the results obtained from the pre-test, necessary modifications were made on the questionnaire. Fifteen enumerators, who had experience in data collection, knew the area and the communities languages were recruited and trained for two day by researcher.

*2. Focus Group Discussion (FGDs):* Six focus group discussions were conducted to collect information on local knowledge and perceptions about land degradation and its socio-economic impacts. Each group was made up of 12 people, comprising 7 men and 5 women. Participants in the group discussions were also thirty years and above for both sexes. People in this age group were chosen because they will be able to give an account of the environmental situation of the area for the past 15 years. Proceedings of the discussions were recorded. These FGDs was conducted in order to get some in-detail information on land degradation nature, causes and consequences, commonly practiced land management practices, community perceptions towards land degradation and its effects on agricultural activities and agricultural performance in general.

3. *Key Informant Interview:* The Interview Schedule was complemented by informal surveys that involved discussions with key informants, including village leaders, extension workers, and district agricultural officials. These informal surveys were conducted in order to get some general overview on soil degradation, community perceptions and agricultural performance in general. These surveys also provided a means and direction in crosschecking the responses from formal interviews. The key informants were found in the respective villages and/or at district level. Information from key informant interviews was analyzed by triangulation with all other sources. To verify the level of awareness of land degradation three exploratory questions were asked. Firstly, whether the study community perceived land/soil degradation as a problem in their villages. Secondly, what criteria are used by this community to determine the quality of land/soil in general. Thirdly, whether they associated land/soil degradation with crop cultivation or livestock management systems of the area. These aspects are addressed in the following sections.18 key informants deliberately chosen because of their extensive knowledge on land management as identified by elders, local administrators and office of agriculture staff.

4. *Field Observation*: Field visits involved observations of various land degradation features, such as soil erosion

and sedimentation, surface runoff, sandiness of soils, crop vigor, presence of indicator-plant species; and agricultural practices, including among others, types of crops grown, cropping patterns and on-farm soil conservation measures. Field observation was conducted throughout the whole process of the research in order to ensure the validity of information obtained from the farmers through interview schedule. To complement the questionnaire and to have a detailed insight into soil conservation practices in the area, a discussion covering different topics with agricultural experts and farmers have been conducted. This helped to capture some points that were not clearly obtained from the interview.

**2.4. Methods of Data analysis**

The study employed both descriptive and inferential statistics to analyze data collected from the sample respondents. To run statistical analysis, data were coded and entered in to a computer program known as SPSS version 20. The information generated through the informal and focus group discussions was used to substantiate and augment findings from the quantitative analysis of the semi-structure interview schedule. The data was analyzed using statistical measures of central tendency (means), and frequency distribution (percentages). The frequency distribution data was cross-tabulated into contingency tables. Knowledge of land management were examined considering the three major types of land use types (forest lands, croplands and grasslands) using World Overview of Conservation Approaches and Technologies (WOCAT) approach.

**2.4.1. Specification of Empirical Model**

Linear Logistic regression model is a widely applied statistical tool to study farmers' perception of land degradation and conservation technologies (Shiferaw, 1998; Neupane *et al.*, 2002). Linear Logistic regression allows predicting a discrete outcome from a set of variables that may be continuous, discrete, and dichotomous or a combination of them. The dependent variable, (i.e., perception of soil and water conservation practices) is dichotomous discrete variable that is generated from the questionnaire survey as a binary response, and the independent variables are a mixture of discrete and continuous. Following the methods of used by Abera (2003) and Mekuria (2005), the logistic regression model characterizing perception of the sample households is specified as:

$$P_i = F(\alpha + \beta X_i) = \frac{1}{1 + e^{-(\alpha + \beta X_i)}}$$

Where *i* denotes the *i*th observation in the sample; Pi is the probability that an individual will make a certain choice given Xi; e is the base of natural logarithms and approximately equal to 2.718; Xi is a vector of exogenous; variables $\alpha$ and β are parameters of the model, β1, β2……, βk are the coefficients associated with each explanatory variables X1, X2, …, Xn. The above function can be rewritten as:

$$\ln\left[P/(1-P)\right] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k$$

Where the quantity *P/ (1-P)* is the odds (likelihoods); *β0* is the intercept; *β1, β2* ... and *βk* are coefficients of the associated independent variables of *X1, X2*...and *Xk*. It should be noted that the estimated coefficients reflect the effect of individual explanatory variables on its log of odds {ln [P/ (1- P)]}. The independent variables of the study are those which are expected to have association with farmers' perception of soil erosion and conservation practices. More precisely, the findings of past studies on the farmers' perception, the existing theoretical explanations, and the researcher's knowledge of the farming systems of the study area were used to select explanatory variables. The definition and units of measurement of the dependent and explanatory variables used in the logistic regression model is presented in Table 1.

**2.4.2. Conceptual Model and Hypotheses and Identification of Variables**

Smallholder Farmers' perceptions of the effects of land degradation and soil erosion could be influenced by the natural physical factors that influence land degradation, as well as the socio-cultural and institutional factors and household demographic characteristics that affect how physical processes are viewed. Physical factors include village level factors (rainfall, topography and level of land degradation) and plot level factors (soil type, slope, shape of slope, and location of plot) that may intensify land degradation and soil erosion. Institutional factors include contact access to extension service , access to media and other information sources, availability of a sustainable land management interventions in the village, prior public conservation campaign works on the farmer's own land (for demonstration effects), and the current tenure status of the field. Household characteristics include education, age and gender. The physical factors that aggravate soil erosion, such as higher rainfall intensity, steep slopes and erodible soils, are hypothesized to raise farmer perceptions of soil erosion by aggravating soil loss. Distance of plot from homestead is expected to reduce perception, as distant plots are less frequently observed by farmers. The period of time the plot has been operated by the current owner is expected to raise erosion perceptions for the opposite reason. Field area (size) should raise perception since the absolute amount of soil and crop yield losses may be higher from larger plots. Farmers who have contact with extension services are expected to have higher erosion perception, since extension is expected to serve as a source of technical information to farmers. The availability of a resource conservation SLM intervention in the village is expected to create awareness perception through its demonstration effect on the need for conservation measures. The effect of public campaign conservation work on the farmer's own plot is ambiguous; it may raise erosion perception through its demonstration effect or reduce perception through its effect on soil loss.

**Table1: Definition and Units of Measurement of Variables Included in the Model (N=156)**

| Explanatory Variables | Variable Code | Variable Type | Units of measurement |
|---|---|---|---|
| Age of household head(in years) | AHH | Continuous | Measured in years |
| Family Size (in number) | FS | Continuous | Measured in numbers |
| Sex of household head | SHH | Dummy | One if male, 0 if female |
| Education level of household head | ELHH | Continuous | Measured in years |
| Farming experience | FEHH | Continuous | Measured in years |
| Tenure type | TS | Dummy | 1 if the HH certified 0 otherwise |
| Land certificate | LC | Dummy | 1 if the HH certified, otherwise 0 |
| Extension contact | EC | Dummy | 1 if the HH certified, otherwise 0 |
| Participation in conservation campaigns | PCC | Dummy | 1 if the HH involved in, otherwise, 0 |
| Availability of SLM project | SLMP | Dummy | 1 if SLM project is available, otherwise, 0 |
| Slope of the plot | SP | Dummy | 1 if the slope of the plot steep, 0 otherwise |
| Type of soil of the plot | TSP | Dummy | 1 if the soil type is sandy, 0 otherwise |
| Distance from residence | DR | Continuous | Measured in kilometers |
| Area of the plot | AP | Continuous | Measured in square kilometer |
| Age of the plot | AP | Continuous | Measured in years of cultivation |

## 3. RESULTS AND DISCUSSION

### 3.1. Characteristics of Sample Respondents

Demographic, socio-economic, institutional, bio-physical and psychological characteristics of the households are directly/indirectly related to factors influencing farmer's perception of the effects of land degradation and the adoption of soil and water conservation practices. Therefore, the demographic and socio-economic characteristics of sample respondents in the study areas were presented and discussed briefly in this section as follows:

**Demographic and Socio-economic attributes of the Respondents (n=156)**

| Variable | | Frequency | Percentage |
|---|---|---|---|
| **Sex** | Male | 96 | 61.53 |
| | Female | 62 | 39.74 |
| **Age** | 20-30 | 21 | 13.46 |
| | 31-41 | 60 | 38.46 |
| | 42-52 | 42 | 26.92 |
| | 53-63 | 17 | 10.89 |
| | 64-74 | 7 | 4.48 |
| | >74 | 3 | 1.93 |
| **Education** | No formal | 87 | 55.77 |
| | Primary | 25 | 16.03 |
| | Secondary | 21 | 13.46 |
| | Certificate and above | 17 | 10.99 |
| **Farming experience (Years):** | 1-10 | 21 | 13.47 |
| | 11-21 | 33 | 21.15 |
| | 22-32 | 41 | 27.93 |
| | 33-43 | 45 | 26.28 |
| | 44-54 | 10 | .6.41 |
| **Farm size** | <0.5 | 98 | 62.82 |
| | 0.5-1 | 49 | 31.41 |
| | >1 | 3 | 1.92 |
| **Extension Service** | Access | 102 | 65.38 |
| | No access | 54 | 34.61 |
| **Credit service** | Access | 62 | 39.75 |
| | No access | 94 | 60.25 |
| **Land holding ownership certificate** | Certified | 109 | 69.87 |
| | Not Certified | 47 | 30.13 |
| **Participation in public conservation campaigns** | Involved in public campaigns | 41 | 26.29 |
| | Not involved in public campaigns | 115 | 73.71 |
| **Slope of the plots** | Steep slope | 97 | 62.17 |
| | **Flat/plain** | **59** | **37.83** |

*Table2: Demographic and Socio-economic attributes of the Respondents*

The average age of household head in the study area was about 42 years. This shows that a majority of the sampled farmers found in the adult category, that is, 44.2 percent of the sampled farmers were aged between

35 and 56 years old. In terms of the level of education attained by the household head, it was found that the average level of education attained was about 3 years of schooling, that is, on average; the household head spent about eight years in school. It was further found that male headed households were more educated than female headed households. The sampled households own an average of 0.526 hectares of land with an average of about two plots per household. This goes to show that most households do not have adequate land on which to farm. In addition, it was found that the farmers had used the land they own for about 33years. This gives an indication that these farmers had used these lands for quite a number of years. Also, it was found that the farmers had an average of 27 years' experience in farming. The experience of 27 years is long enough for one to adapt to the new land management practices used in the area. It was also found that a majority of the households owned livestock. That is, 82 percent of the sampled households owned livestock while 18 percent did not own livestock. Out of the total sample respondents 54.68 and 55.32 % respondents reported that the status of their farm land is steep sloped and flat/plain respectively.

### 3.2. Farmers' Perceived Causes of Land Degradation in the Study Area

Answer to the inquiry on whether the local community perceived land degradation as a happening and as a problem in their farmland and surrounding landscapes have shown that 86.54% of the respondents considered land degradation as happening and being a serious problem in their locality. The farmers' perceived various causes of land degradation in their farmlands and surrounding landscapes. Table 3 presents the locally perceived causes of land degradation that were mentioned by the respondents as being the cause for the observed land/soil degradation in the study areas.

**Farmers' Perceived Causes of Land Degradation in the study area**

| Farmers' perceived causes land degradation | Frequency (n=156) | Percentages (%) |
|---|---|---|
| **Continuous cropping** | 63 | 40.38 |
| **Deforestation** | 56 | 35.9 |
| **Overgrazing** | 28 | 17.95 |
| **Cultivation of marginal lands** | 57 | 36.54 |
| **Inappropriate tillage practices** | 32 | 20.51 |
| **Low adoption of SLM measures** | 59 | 37.82 |
| **Torrential rains and drought(weather extreme events)** | 42 | 26.92 |
| **Soil erosion** | 47 | 30.13 |
| **I don't know** | 21 | 13.46 |

Table: 2. Percent responses on Local community knowledge of causes of Land degradation problems.

*****Note: n is frequency of responses (multiple responses) for each cause except for 'I don't know response'***

About 40.38% of the sample respondent households associated the cause of land degradation to continuous cropping considered to be responsible for the retreating soil fertlity. Continuous cropping without fallowing and/or without nutrient supplementation was perceived by farmers as the most important cause of land degradation in general and soil fertility decline in particular. The farmers elucidate that when the land is cropped every year without rest, the nutrients in the soil are exhausts and therefore the land can no longer provide adequate nutrients required for the vigorous growth of the crops. The reason for continuous crop growing was the increasing land shortage because of high population growth that has led to intensified crop cultivation and short or no fallow periods (Eyasu, 2002). Most farms are cultivated every season without fallow and are thus subjected to continuous loss of soil fertility. Population growth and the consequent increase in demand, continuous cultivation and farm expansion to feed the growing population, have been outlined as the causes of continuous cropping (Getnet and Mehrab, 2010). Problems of population pressure were also believed to be as an underlying cause of land degradation during the discussion. The growth of population is exacerbating the situation. Thus land is fragmented and farmers are compelled to cultivate on hillsides and steep slopes.

As the survey data result reveals the other causative factors perceived by the local community to be responsible for the land degradation were low adoption of SLM practices (37.82%), cultivation of marginal/steep slopes (36.54%), deforestation(35.9%), soil erosion(30.13%), Torrential rains and drought(26.92%), Inappropriate tillage practices(20.515) and Overgrazing(17.95%). Low adoption of SLM measures is the second driving factor significantly contributed to the land degradation problem elucidated by the farmers. Thus effective extension services are possibly needed to create awareness regarding various mechanisms that may contribute to sustainable farm production, such as on-farm erosion control, agroforestry practices and proper residue management. Proper farmer education would inculcate the culture of conservation among communities. Soil erosion was also negatively impacting on soil fertility as the rich top soils are removed due to the exposure of the land for more than half of the year. Farmers said bushfires were the number one factor that exposes the soil to erosion (Dejene *et al*, 1997). Other factors that expose the soil were overgrazing, land clearing or the gather and bum' practice of land. So, it can be concluded that study area is affected by land degradation by one causative factors or the other and the local communities have generally perceives land degradation as problem in their Villages as it is illustrated in table3.

### 3.3. Farmers' Perceived Indicators of Land Degradation

Findings from the survey result showed that there are several local knowledge's the communities use to evaluate and to explain the quality of the land and the soils they are cultivating. Three categories of responses appeared to be most outstanding, namely crop vigour and crop yields, presence of strange -plant species/germination of weeds and density of vegetation under fallow (Dejene *et al,* 1997). Result from this study reveals that there are numerous long-established local communities' knowledge use to assess and to explain the quality of their land and the soils they are cultivating. A healthy and vigorous crop growth, reflected by a good crop stand in the field, was usually used as an important indicator that the soil is fertile enough, if moisture and other factors are not limiting. Under such circumstances, even if the weather conditions worsen during the growing season such that final yields are poor, the farmer would have realized the potential fertility of a certain piece of land. A underdeveloped crop with less vigorous growth in the field when other factors such as precipitation are considered not limiting was locally perceived to indicate a high probability that soils on which the crop is growing are of low quality and infertile. Majority of respondents (65.38%) considered crop yields as the best measure to understand farmland status/ condition. It was noted that declining crop productivity could be a clear indicator of declining soil fertility, and hence soil degradation and land degradation. It was noted that declining crop productivity could be a clear indicator of declining soil fertility, and hence soil degradation. The use of this indicator by the local farmers in evaluating land quality is also cherished by experts in land degradation, where crop output decline is regarded as a proxy indicator of soil degradation in farmlands (Dejene et al, 1997; Mitiku *et al,* 2006; Lakew *et al.,* 2000). It is particularly important because it affects people directly in terms of food availability and security. However, this factor only is not enough to conclude that degradation is taking place since cropping conditions vary significantly between years and between individual farmers. The effect of other factors such as crop pests and diseases and climate variability may influence crop yields (Arega and Hassan, 2003; Tesfaye, 2003; Habtamu, 2006; Shiferaw, 2016; Shiferaw *et al,* 2011). In the study kebeles, most of the respondents indicated also that low crop yields could be due to low and/or erratic rainfall.

**Farmers' Perceived Indicators of Land Degradation**

| Farmers' Perceived Indicators | Frequency (n=156) | Percentages (%) |
|---|---|---|
| Declining crop yield and land productivity | 92 | 65.38 |
| Germination and expansion certain strange vegetation/grass species/weeds | | 63 |
| | 55.77 | |
| Gullies and rills formation | 67 | 42.95 |
| Change in the colour of the soil | 16 | 10.26 |
| Sedimentation of sandy materials | 65 | 41.67 |
| Decline in soil fertility | 98 | 62.82 |
| Changes in color of rivers and streams | 17 | 10.89 |

Table 4 presents the proportions of responses on indicators of farmers' awareness of land degradation processes.
***Note: n is frequency of responses (multiple) for each measure.**

Declining soil fertility was perceived as the major indicator of soil degradation in the studied villages. A majority of the farmers (62.82%) attributed such decline to continuous cultivation without resting the fields, whereas 20% ascribed it to inadequate application of manure and/or fertilisers. One explanation to continuous cultivation was the increasing land shortage that has led to intensified crop cultivation and short or no fallow periods. Those who perceived soil degradation as a problem mentioned the generally low but declining soil fertility, soil erosion and runoff, sandiness of soils and sedimentation as key indicators of soil degradation in their villages. Soil erosion and surface runoff featured as indicators of soil degradation as indicated by about 44% of respondent farmers. Physical observation of the landscape in these villages substantiates the local communities' knowledge. All the sample *kebeles* have landscapes cut apart by more evident gullies *table4*). With regard to physical changes in the soil, the local people identified soil erosion and soil compaction as major indicators of land degradation. Analysis of questionnaires indicated that 86% of respondents were aware that soil erosion is taking place on their lands while about 14% did not observe erosion occurring on their lands. Farmers who did not observe erosion on their land said there is no serious run-off on their farms due to the relatively flat nature of the landscape. For these farmers, erosion is only evidenced by rill or gullies and since these processes were not occurring on their farmlands, they concluded that no erosion had taken place. The farmer on whose land gully erosion was found said that it started as a small gutter but is developing into a big river in the rainy season. Sheet erosion was identified through a lot of indicators which include the levelling of ridges and mounts constructed prior to planting, the accumulation of soil particles behind obstacles, the appearance of stones on farms and the washing away of plants or the exposure of plants' roots (e.g. Dejene et al, 1997; Morges and Holden, 2007 ).

 

During focus group discussions, most fanners indicated that the roots of their crops get exposed or carried away by run-off.Some of the respondents said that after Torrential rains, they have to gather soil around the crops whose roots have been exposed. Farmers residing in valleys stated that soils are usually carried away from upstream and deposited on their farms after heavy down pours, sometimes burying their plots. Other farmers elucidated that though sheet erosion may not be noticeable on their lands, the number of pebbles and stones on their farmlands are increasing, indicating that these stones which were previously buried are now being exposed as the soil is little by little washed away.

As the survey result shows (table 4), the local communities in all the sample *kebeles elucidated* that germination and expansion certain strange vegetation/grass species/weeds are the predominant (55.77%) indicator of degraded lands. So, previously farmers leave their farm plots for fallowing and/or applications of manure if the plot is homestead plot when these germination and expansion certain strange vegetation/grass species/weeds as soil fertility management measure. Now a days because of land shortage fallowing is impossible for the farmers

Sedimentation of the soil was perceived as a problem by 41.67% of the sample respondent farmers (*table4*). This response was principally obtained from farmers whose fields laid in stabilizing sand fans that have soils with very low organic matter levels, low moisture holding capacity and poor fertility status. Sedimentation was reported to take place in depositional footslopes and valley bottoms where the eroded materials from hill slopes accumulate. Farmers detect soil compaction through the resistance of the soil to work or its failure to support plant life. Soil compaction was observed along footpaths, trekking lines and places where animals usually gather to rest areas. The compacted soils become infertile.

The existence of these indicators could confirm that rural people are aware of their environment and its related problems, and particularly so with those which affect the farm productivity and/or those that resulted into more visible landscape changes such as soil erosion. Land degradation was identified by local residents through changes in crop yield as well as physical changes in the soil from questionnaire survey analysis. Local people associated reduction in crop yield with depletion of soil nutrients and rainfall variability (*table4*). As shown in the table, the majority (65.38%) of respondents attributed a reduction in crop yield to low soil fertility. The presence of these indicators seem to show that rural people are aware of their environment and its related problems, and particularly so with those which affect the farm productivity and/or those that resulted into more visible landscape changes such as soil erosion. However, the fact that less than half of the respondents indicated that soils are inherently infertile suggests that productivity has declined significantly within living memory and that people were unaware that their yields were probably rather low from the outset.

### 3.4. Effects of Land Degradation from Local Knowledge Perspective

Land degradation has diverse effects on individual farmers, the community and the environment. Generally, the effects include loss in soil fertility, siltation of water bodies, low agricultural productivity and crop yield, food insecurity and poverty(Arega and Hassan, 2003; Tesfaye, 2003).Natural cycles (carbon, nitrogen, phosphate, and water cycles) and biodiversity were also affected. The survey result shows that 71.15% of respondents perceived that land degradation results in households' food insecurity and abject poverty situation while 69.23% of respondents perceived that it results makes arable lands infertile. 65.38% of respondents perceived that land degradation results in Declining crop yield and land productivity and ecological services are severely affected while56.41% of the respondents perceived that it results in siltation of water bodies so that socio-cultural services were less affected. But some of the FGD participants argue that agricultural production and water quantity were seen to have declined drastically, whereas water quality was reported to have deteriorated more gradually.

**Effects of Land Degradation from Local Knowledge Perspective**

| Effects of land degradation | Frequency (n=156) | Percentage (%) |
|---|---|---|
| **Reduced soil fertility** | 108 | 69.23 |
| **Declining crop yield and land productivity** | 92 | 65.38 |
| **Siltation of water bodies** | 88 | 56.41 |
| **Food insecurity and poverty** | 111 | 71.15 |

Table 5 presents the proportions of responses on effects of land degradation from Local Knowledge Perspective.
***Note: n is frequency of responses (multiple) for each measure***

Soil erosion causes soil loss, with socio-economic and environmental consequences which vary among the soil types and communities. The most important consequence is a diminution in soil fertility which poses a serious challenge to crop production. As soils are carried away, the nutrients associated with them are also carried away, resulting in a lessening in soil fer1iility which will impact harmfully on crop yield. As shown in Table (5), about 65.38 percent of farmers associated the poor crop yield to a loss in soil fertility. These farmers argued that even years of good rains in recent times do not give them good crop yield as it pertained 10 years ago. The farmers' assertion corroborated studies conducted in the area by (Senayah 1994; Nye and Stephens, 1962;

 

Adu, 1969) which show a declining trend in soil fertility. The low crop yield has affected farmers' income and food security. Most farmers said they could not meet their food requirements, especially in the lean season. Some said they eat twice a day while others eat once a day during this time of the year. This has nutritional implications, especially for pregnant women and children. Low productivity has also affected the farmers' income since agriculture is their most important economic activity. It has also been revealed by Dejene et al (1997) that loss in soil productivity leads to reduced farm income and food insecurity, particularly among the rural poor. The economic hardship is compelling the local people in the study area to migrate to the other parts the country for alternative livelihoods.

**3.5. Community Participation in Sustainable Land Management Practices ((SLM)**

Lasting productivity and sustainability of the agricultural land entails sound sustainable land management practices in the farming systems that enhance maintenance and/or improvement of soil and land quality in general(Habtamu, 2006;Arega and Hassan, 2003; Tesfaye, 2003). This is an important consideration as it influences agricultural productivity and local livelihoods. In many instances land degradation has stimulated a variety of responses and adaptation mechanisms by local communities. This study conducted an enquiry on whether farmers had undertaken any deliberate efforts to conserve their land holdings from land degradation. Majority of respondents (67%) indicated to have used one or more conservation measures in their farms as a means of adjusting and adapting to land degradation processes. Soil and water conservation measures have been practiced in the study area since the late 1970s (Lakew et al., 2000). SLM measures have been practiced in the study area fall into three major categories, specifically agronomic (e.g. mulch, organic manure, changing species composition of crops, controlling cropping intensity and fallow period), vegetative/biological (e.g. tree, shrub and grass cover), Structural SWC measures (e.g. terraces, bunds and ditches). Based on the respondents' perception, each of these measures can be applied for specific purpose. According to Table 6 and as shown by responses, agronomic measures are the most popular conservation measures adopted to deal with soil erosion, followed by vegetative measures and then by structural SWC measures in the study area.

**Adopted SLM practices**

| **Sustainable Land Management Practices implemented** | **List of Sample *Kebeles*** | | | | | |
|---|---|---|---|---|---|---|
| | *Ale Aykina(n=57)* | | *Aykina Kasike(n=53)* | | *Ala Wuzete(n=46)* | |
| | Frequency | Percentage | Frequency | Percentage | Frequency | Percentage |
| **Agronomic measures** | 27 | 47.37 | 24 | 45.28 | 21 | 45.65 |
| **Vegetative(biological) measures** | 16 | 28 | 18 | 33.96 | 17 | 36.96 |
| **Structural SWC measures** | **14** | **24.56** | **11** | **20.75** | **7** | **15.22** |

*Table 6 Adopted SLM practices*

**3.6. Constraints to Community Participation in Sustainable Land Management (SLM) Practices**

Community participation in sustainable land management practices is of great importance as it seeks to guarantee access and control over resources by the communities living in them, but who depend on these resources to satisfy their various needs (ecological, economic, social, cultural and spiritual needs). Community participation ensures more commitment in ensuring that resources are more sustainably managed, where apart from communities depending on these resources for a living and conserving them, they at the same time become their guardians (Arega and Hassan, 2003; Tesfaye, 2003; Lakew et al., 2000; Yilkal, 2007; Habtamu, 2006).The active participation of various stakeholders in decision making is crucial for ensuring the long term sustainability of community-based resource management initiatives. In several occasions however, sustainable land management has not received the expected involvement of local communities. Some of the reasons that have influenced the local people's participation SLM practices in the study area are discussed here.

***Constraints to Community Participation in Sustainable Land Management (SLM) Practices***

| Constraints to adoption of SLM practices | Frequency(n=156 ) | Percentage (%) |
|---|---|---|
| **Lack of incentives** | 72 | 46.15 |
| **Labour intensiveness** | 66 | 42.3 |
| **Land shortage** | 69 | 44.23 |
| **Financial constraint(Poverty)** | 109 | 68.87 |
| **Complexity Conservation measures** | 76 | 48.71 |

*Table7 Constraints to Community Participation in Sustainable Land Management (SLM) Practices*

****Note: n is frequency of responses (multiple) for each measure***

A financial constraint (poverty) was the main reason reported for not being able to implement SLM practices (mentioned by 68.87% of people as presented in table 7). Artificial fertilizer, ranked most highly in terms of their capacity to improve the soil is also the most expensive measures. It does not follow however that is the poorest that degrade the land most (or that it is the wealthiest who invest most in the land, as shown above). The poorest are often eager to sell their labor, as they are desperate for cash income to buy necessities. In so doing they are rarely able to cultivate all their own fields and so these fields benefit from more regular fallowing than those belonging to wealthier people. This defenses Dejene et al's (1997) findings that the poor face financial and socio-economic constraints which seriously impede management practices and innovations.

Lack of adequate incentive was the main reason that people cited for being unable to implement SLM Practices (reported by 46.15% of people as presented in table 7). Land quality is important variable affecting incentives in this area. The FGD data reveals that that 'the more productive or profitable the land use the more farmers will be willing to maintain and invest in better land management and erosion control practices. Relatively flat, irrigable land suitable for vegetable production generates greater returns to labor and capital, and therefore a stronger incentive to invest. Thus it receives much more attention than steeply sloping fields given to maize and beans.

Land shortage was the main reason that people cited for being unable to implement erosion prevention methods (44.23%) as trees and terraces both absorb land and trees further shade crops. It was also cited as a constraint to improving fertility by 37% of people (referring to the desire for longer and more frequent fallows). Thus population pressure, (as it lowers per capita land availability), could be regarded as a factor contributing to degradation in Study areas but other factors affect whether this results in intensification with soil improvement or degradation. Local people will not convert their ladder terraces into more permanent terraces because they say they would be too labor intensive to maintain (it would involve digging residues into the soil twice annually rather than pulling soil down slope to bury them). With significant rates of out-migration, labor can hardly be said to be a constraining variable to land improvement— thus returns to labor, as outlined above, must be regarded as more significant.

The survey result also revealed conservation measures are so complex that they do not understand exactly how to go about their implementation (noted by 48.71% of people).. This arises due to lack of consultation with the community in enacting the policies. This point is consistent with the view of Rogers (Reed and Dougill, 2009; Reed et al, 2006), that innovations which are difficult to understand and implement are less likely to be adopted than technically simple ill innovations, although the scientifically rigorous indicators used in the top-down paradigm may be quite objective, they may also be difficult for local people to use. It was reiterated that some of these measures require financial investment which they do not have, and therefore they are unable to implement them.. This lowers the productivity and income of the poor and reinforces the "vicious cycle" of poverty and natural resource degradation. This means that if land degradation is to be managed sustainably, and then the communities need to be involved in the planning process and resourced to implement projects introduced by authorities

Also the others the reasons elucidated was the taking too lightly the severity of the land degradation risk by many people in the area. Where the tenure system is not guaranteed individual farmers may not be concerned with problems of land degradation regardless of their holdings being at risk as such land degradation is considered as a general community problem. Such attitudes may result in no action being taken against land degradation even when there are no clear hindrances. The implication of the foregoing is that effective conservation is likely to be achieved when land tenure systems are properly secured and articulated. Thus efforts are needed to ensure integrated community-level planning that could promote individual farmers efforts without undermining community interests. Adoption and/or practicing certain SLM measures are much influenced by the farmer's economic situation, including resource endowments. For instance, farmers with sufficient land holdings can afford to conserve by fallowing and constructing various physical SWC stractures, while land constrained farmers may not. Similar experiences would be the case for other conservation measures that require heavy investment by the farmer, for example making of soil erosion control structures that may need additional labour, and using fertilizers and/or manure.

From the in-depth interviews held with FGDs participants on management, institutional barriers were identified as another challenge of community involvement. Poor coordination between farmers, traditional/local authorities and NGOs was seen as a major barrier to land management in the area. Reasons assigned for the lack of coordination were conflict of interest among stakeholders, especially concerning resource use and control, the seemingly entrenched stance of some traditional or local authorities on issues relating to land and its use, and the difficulty in convening meetings of all stakeholders to identify priority projects to be undertaken. The lack of coordination among stakeholders (farmers, traditional authorities, governmental agencies, NGOs, etc) sometimes results in duplication of efforts in some areas whereas other places receive little or no attention at all.

Furthermore, lack of genuine involvement between local communities, NGOs and governmental agencies who undertake conservation projects is holding back sustainable land management in the in the study area. This situation often results in a top-down approach to planning. For example, authorities design conservation plans with the scientific knowledge available and then take them to the people for execution, a process which usually leads to inappropriate execution or to the failure of some conservation efforts. Also, a top-down approach may result in the location of projects at sites that may not be fitting to the inhabitants. The household survey reveals that most projects which did not involve the local people at certain levels of planning failed. 79% of the interviewed farmers held the view that their knowledge is very relevant to any intervention exercise and therefore should be sought before any plan is implemented, whereas 21% held a opposing view. Those who saw the relevance of local participation in land management stated that local people should not only be viewed as a labour pool for conservation projects but as people whose experience in the area as land users has given them enough knowledge to share.

Conservation practices are adopted when local communities have satisfied basic needs. Besides population pressure, other factors also need to be evaluated, such as the support of public institutions and sufficient cohesion of local communities, especially a strong community organization. The combination of these factors will result in the decision and the capacity of land users to invest time and resources in land conservation. Decision-making about land management and land degradation should encompasses, among others, factors that may be biophysical (agro-ecological conditions, location), economic (access to credit and markets, non-farm incomes, availability of technologies), social (organizational structure, labor availability, land tenure), historical (environmental history and that of land tenure) and cultural (traditional knowledge, environmental awareness, and gender). Socioeconomic and cultural factors should receive crucial attention in policy decision-making. For instance at a time, the attitude of local communities may be more critical than the availability of technology; the latter, although an important issue, may only be a tool to achieve goals in a social context.

### 3.7. Determinants of Farmer Perceptions of the Severity and effects of land degradation on productivity agriculture

Answer to the inquiry on whether the study community perceived soil degradation as a problem in their villages have shown that 58% of the respondents considered soil degradation as being a serious problem in their vicinities. These perceptions may be influenced by differences in socio-economic characteristics inherent among the local people. Socio-economic characteristics such as endowment of livelihood assets by households determine the ability of a household to use, for example, agricultural inputs like fertilisers or manure as a way of improving soil productivity. In the study area, for instance, wealthy farmers who could afford using fertilisers and/or manure did not perceive soil fertility as a major issue.Logistic regression model was used to analyze determinants of farmers' perception of the effects of land degradation risks on agricultural productivity. The success of the overall prediction by the regression model indicate that the variables sufficiently explained the perception of farmers on conservation practices, and there is a strong association between the perception and the group of the explanatory variables ($R^2 = 0.802$). A positive estimated coefficient in the model implies increase in the farmers' perception of soil erosion and conservation practices with increased in the value of the explanatory variable. Whereas negative estimated coefficient in the model implies decreasing perception with increase in the value of the explanatory variable.

Extension contact: As hypothesized, extension contact is found to have a significant positive Influence on the perception of the severity and effects of land degradation on agricultural productivity. This may be explained by the fact that scientific information and research result reports that farmer gain from extension agents help them to aware and understand the severity and effects of land degradation on agricultural productivity. Therefore, Farmers who had frequent contact with extension agents perceived productivity decline associated with land degradation (Arega and Hassan, 2003; Tesfaye, 2003).

Availablity of SLM project in the village: implementation of SLM project in the village positively influenced and aware farmers about the risk of decline in agricultural land productivity due to land degradation and soil erosion. This could be justified by SLM projects effort of attempt to participate the farmers in processes and awareness creation and capacity building through experience sharing from other successful project areas. Participation/training on agricultural land management SWC measures and etc. has a positive and significant effect on conservation perceptions. Farmers who participated in training by development agents on SWC works were more aware of soil erosion and conservation than those who did not participated.So, this finding corroborates with Nagassa *et al.* (1997) findings in Ethiopia reported that training of farmers and their participation in extension workshops improves their perception of soil degradation problem and facilitates the adoption of improved technologies.

Age oh household head: The finding of the study reveals that age of the household head has a negative influence on the perception of the risk of decline in agricultural land productivity due to land degradation and soil erosion. This means that aged farmers tended to perceive severe yield loss or productivity decline, in contradiction to other finding that younger farmers perceived higher erosion.

 

**Table6: Logistic regression result for perception of the effects of land degradation risks**

| Variables | β | SE | Z | Sig | Odds Ratio |
|---|---|---|---|---|---|
| Age of household head | 0.037*** | 0.658 | 0.898 | 0.0890 | 0.040 |
| Family Size | 0.167 | 0.138 | 1. 230 | 0.272 | 0.023 |
| Sex of household head | 0.245** | 0.006 | 1.980 | 0.0967 | 0.011 |
| Education level of household head | 0.0847** | 0.726 | 2.500 | 0.048 | 0.131 |
| Farming experience | 0.208** | 0.038 | 0.360 | 0.023 | 0.101 |
| Tenure type | 0.280* | 0.657 | 1.980 | 0.662 | 0.34 |
| Land certificate | 0.078 | 1.872 | 1.160 | 0.723 | 0.162 |
| Extension contact | 0.876* | 0.182 | 1.740 | 0.024 | 0.056 |
| Participation in conservation campaigns | 0.087** | 0.086 | 1.420 | 0.0340 | 0.021 |
| Availability of SLM project | 0.062** | 0.467 | 0.440 | 0.0876 | 0.031 |
| Slope of the plot | 2.286** | 0.025 | 2.010 | 0.0965 | 0.023 |
| Type of soil of the plot | 0.834 | 0.100 | 1.070 | 0.0956 | 0.231 |
| Distance from residence | 0.147 | 0.064 | 1.600 | 0.782 | 0.031 |
| Area of the plot | 1.720 | 0.0676 | 0.240 | 0.345 | 0.045 |
| Age of the plot | 0.070** | 0.078 | 0.340 | 0.024 | 0.021 |
| Constant | -1.703*** | .346 | -1.690 | 0.114 | |

Model Chi-square 98.280
Log likelihood function 72.165
Nagelkerke ($R^2$) 0.802
Number of observation 156

***, **, ***significant at 10, 5 and 1% level of significance, respectively.***

Educational level of household heads: Education of the head of the household significantly and positively determined farmers' perception of the risk of decline in agricultural land productivity due to land degradation and soil erosion. Possible explanation is that educated farmers tend to be better access to research output reports and generally to update information about the risks associated with land degradation and soil erosion and hence tend to spend more time and money on soil conservation. This is because literate farmers often serve as contact farmers for extension agents in disseminating information about agricultural technologies from government agencies. The odds ratio also suggests that if a farmer is educated, other factors held constant, the likelihood of awareness will be two times higher than an illiterate farmers. However, the other variables, such as family size, tenure type, land certification, gender, family members in farm work, as well as physical factors, such as the slope of the terraces and altitude, did not significantly influence the perception of the risk severe yield loss or productivity decline and had only weak explanatory power in the model.

### 3.8.Conclusion and Policy Implication

The study result showed that farmers perceived land degradation in their physical environment, particularly in soil and vegetation. The changes observed include soil erosion, loss in soil fertility and deforestation. Farmers in the study area were generally aware of and perceived soil erosion as a serious problem and its effect on agricultural land productivity. Their possibility of perceiving its effect on agricultural land productivity as slight to severe was primarily determined by institutional and demographic factors as well as weakly by biophysical factors. The socio-institutional and demographic determinants of the effects of land degradation and soil erosion risks on agricultural productivity decline point to policy implications for public inclusive SLM practices and capacity building programs as well as bringing back indigenous land management practices to research and learning platforms for sustainable and desirable societal betterment. The fundamental forces for these changes are the increasing human and animal population; rising temperatures; and unreliable and declining rainfalls resulting in widespread environmental and socio-economic problems such as overgrazing, fuel wood fetching, land clearance for fanning, and drought. Institutional barriers such as poor coordination, ineffective implementation of policies, lack of data sharing and lack of consultation amongst stakeholders are also militating against sustainable land use planning in the Municipality. The effects of land degradation are diverse and include scarcity of wood products for building and domestic energy supply, less pasture for animals and low crop yield which is increasing poverty and hunger amongst the local people. The coping strategies regarding this environmental challenge include the application of fertilizers, planting of early maturing/drought tolerant crops, dry season gardening/irrigation and mixed cropping. The survey result reveals that sustainable land use management in the community requires the involvement of the local people and integrating local knowledge at both the drafting and implementation stages of policies as these farmers possess rich knowledge about their physical environment that could be tapped to enhance policy formulation and implementation.

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